SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION - LITERATURE REVIEW AND CLINICAL SURGICAL CASE PRESENTATION

EXPANSÃO RÁPIDA DA MAXILA CIRURGICAMENTE ASSISTIDA - REVISTA DA LITERATURA E APRESENTAÇÃO DE CASO CLÍNICO CIRÚRGICO

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ABSTRACT

Treatment of dentofacial deformities is frequently complicated for discrepancies of maxilla transversal dimension. Correction of those deformities, orthopedics, or surgical-orthopedics, aims separation of maxillary bones in midline. Rapid maxillary expansion is effective technique in treatment, however individual developmental stage limits it. Present case patient, 22 years old, female, with maxillary transversal deficiency, was submitted to surgical assisted rapid maxillary expansion. Were achieved osteotomies of anterior and lateral wall of maxilla, nasal septum, pterigomaxillary and intermaxillary buttress. Activation of expansion device had beginning 48 hours after surgery, with one quarter of turn, twice day, by 20 days. Due to discordance presented in literature about treatment their type of deformity, mainly in relation decision of orthodontic or surgical-orthodontic expansion, and surgical technique employed, it makes this report, with objective to define best conduct.

RESUMO

Tratamento das deformidades dento faciais é frequentemente complexo por discrepâncias na dimensão transversal (horizontal) da maxila. Correção destas deformidades, ortopédicas ou ortopédico-cirúrgicas, visa separação dos ossos maxilares na região da sutura intermaxilar. Expansão rápida da maxila é técnica eficaz no tratamento destas deformidades, porém limitada pelo estágio de desenvolvimento do indivíduo. É apresentado caso, de paciente com 22 anos, gênero feminino, com deficiência transversal da maxila, submetida à expansão cirúrgica da maxila. Foram realizadas osteotomias das paredes anterior e lateral da maxila, sutura pterigomaxilar, septo nasal e, sutura intermaxilar. São discutidas técnicas descritas para realização do procedimento e, sua eficácia. Devido discordância na literatura sobre seu tratamento, principalmente quanto à decisão de expansão ortodôntica ou ortodontico-cirúrgica e à técnica cirúrgica a ser utilizada, realizou-se este trabalho, com objetivo de definir conduta.

Uniterms: Rapid maxillary expansion; Surgical technique; Orthodontic technique; Surgical clinic case presentation.

Unitermos: Expansão rápida maxila; Técnica cirúrgica; Técnica ortodôntica; Apresentação de caso clínico cirúrgico.
INTRODUCTION

Treatment of adults with dentofacial deformities is often complex due to existence of discrepancies in horizontal dimension of maxilla (MARZOLA, 2008).

Horizontal deficiencies are characterized by hypo-development of this structure, leading to maxillo-mandibular discrepancy, causing impairment to occlusal stability, besides constriction of nasal cavity, phonetic alterations, mouth breathing, etc. Correction of deformity becomes beyond aesthetic, functional order procedure (MARZOLA, 2008).

Correction of these deficiencies, orthopedic or orthopedic-surgical, aims at separating maxillary bones in region of midline. However, this procedure also leads to alterations in other sutures, promoting reorganization of facial skeleton (BAYS; GRECO, 1992; ENLOW, 1998 and MARZOLA, 2008).

First report of orthodontic expansion of maxilla dates from 1860, when ANGEL described expansion of maxilla of 12-year-old girls (MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998). ERM was reintroduced and, applied to correction of real or relative transverse deficiencies, maxillary collapse, maxillary retrusion and Class II skeletal malocclusion, division I (HAAS, 1961).

This and other studies have demonstrated feasibility of technique, but its accomplishment is related to development phase of individual, being possible only in those where suture is not consolidated. This consolidation would begin between 15 and 19 years (PERSSON; THILANDER, 1977 and MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998).

Although authors advocate orthodontic expansion in adults, this procedure commonly involves damage to dental and periodontal tissues, such as changes in tooth angulation, alveolar bone loss, and gingival recess, etc. It leads to intense local pain, causing large number of patients to withdraw from treatment before its end (CAPELLOZA-FI; CARDOSO-NETO; SILVA-FI et al., 1996 and MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998).

When orthodontic expansion is no longer possible, it becomes necessary surgically assisted, aiming to remove areas of bone resistance to movement of jaw. Studies have described that area of greater bone strength at separation of jaws would not be intermaxillary suture, but zygomatic temporal, zygomatic, and zygomatic maxillary sutures (LINES, 1975; BELL; EPKER, 1976; CAPELLOZA-FI; CARDOSO-NETO; SILVA-FI et al., 1996 and MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998).
In search for less traumatic and invasive procedures for patients, several techniques for surgically assisted expansion are developed. Although simplification is natural tendency, it can lead to failures in treatment for disrespect to certain essential steps. Due to disagreements presented in literature on treatment of this type of deformity, mainly as decision by orthodontic or orthodontic-surgical expansion, and to surgical technique to be used, this work was proposed, with purpose of defining conducts, besides justifying their accomplishment.

**LITERATURE REVIEW**

Diagnosis and treatment of transverse maxilla deficiencies have been widely discussed in literature, especially after middle of last century. Seeking better understanding of subject, literature review was divided into four topics, diagnosis, treatment, results obtained and postoperative complications.

**Diagnosis**

Medial or intermaxillary palatine suture is of great importance in process of maxillary expansion. Behavior of this suture was observed in cadavers of children and adults. In child, suture, in coronal section, is Y-shaped. In young, it has T-shape with serpentine-shaped joint. In transition to adulthood, suture can become interdigitated, such that bone islets can be observed and may present with melting areas with time (Melsen, 1975).

Ossification of intermaxillary suture begins between 15 and 19 years, increasing significantly in third decade of life (Persson; Thilander, 1977).

Diagnosis of transverse discrepancies may cause difficulties for surgeons and orthodontists trained to evaluate malocclusions and other dento-facial deformities due to clinical manifestations presented, with patient in habitual position of abnormality. To obtain correct diagnosis of these deformities, it is necessary to make study models, evaluating them in different position, in class I of canines. Discrepancies can be divided into two categories, relative or absolute. Relative are observed in exam in usual position, disappearing when evaluated in this new position. Absolute are those that, even with evaluation of class I models, continue to exist (Bell; Jacobs, 1979).
Due to initial period of suture closure, orthodontic expansion up to 25 years of age is recommended, and option for osteotomies when suture has not been opened after one week of daily expander activation (TIMMS; VERO, 1981).

Relationship between maxillary bone hypoplasia and nasal respiratory failure was studied in group of 20 children with malocclusion being treated by ERM. Prior to treatment, all patients presented endognatic with skeletal discrepancies of -4 to -7 mm. They were frequently associated with adenoid hypertrophy (70% of cases), increased total nasal resistance (70%), oral breathing (80%), and diseases of middle ear (30%). ERM leads to resolution of occlusal changes in all cases and often also leads to regression of adenoid hypertrophy (57% of cases), normalization of total nasal resistance (70%) and normalization of nasal breathing (80%) (PICCINI; GIORGETTI; FIORELLI, 1989).

There is growing consensus that upper airway obstruction is causal factor for nocturnal enuresis. Obstruction is usually caused by adenoid hypertrophy or, less commonly, anterior nasal stenosis. In many cases, constriction can be reduced by rapid maxillary expansion. In the 10 cases examined in this study, nocturnal enuresis ceased with few months of maxillary expansion (TIMMS, 1990).

There are three treatment possibilities for transverse maxillary deficits, orthodontic expansion, ERM, and surgically assisted maxillary expansion. Orthodontic expansion is usually used during period of deciduous and mixed dentition. ERM is most often indicated in the mixed dentition, and attempt can be made in permanent dentition. ERM is applied almost exclusively in adults. Treatment will depend on the age and skeletal maturity of patient. Maxilla is separated in midline, zygomatic maxillary suture and, pterygomaxillary suture. Literature review shows good results with surgical expansion for treatment of transverse maxillary deficiency in adult patients (BANNING; GERARD; STEINBERG, 1996).

Rapid maxillary expansion presents high failure rate when performed in patients with advanced skeletal age, indicated only to those with incomplete bone maturity. Applications of orthodontic-surgical techniques allow correction of transverse deformities in adult patients with fairly acceptable predictability, and few reports of complications, making it an excellent treatment choice. Brief review of literature and clinical/surgical case presentation treated at Buco Maxillo Facial Surgery and Traumatology Service of the Base Hospital of Bauru, São Paulo, Brazil is demonstrated in this article, with advantages, indications and surgical techniques being discussed (PASTORI; MARZOLA; TOLEDO-FI, 2007).
Treatment

Patients over 16 years of age, attempted ERM is often associated with difficulties. It is due to result of fusion of several craniofacial sutures, resulting in lack of opening of suture in expansion. Inability to activate appliance and expand jaw is not uncommon. Tilting teeth, loss of alveolar bone, and movement of teeth through vestibular cortical bone are common consequences of rapid orthopedic expansion in adults (WOLFORD; EPKER, 1980).

Many cases of orthodontic maxillary expansion have been reported in adults. In one, 19-year-old man requiring correction of malocclusion that included transverse maxillary deficiency, was informed that he would need orthognathic surgery, for maxillary expansion and correction of malocclusion, but he refused to undergo surgical treatment. Recent evidence indicates that ERM can be used without surgery in young adults. Hyrax expander was installed and, after uneventful procedure, it was followed with post-treatment radiographs revealing opening of intermaxillary suture (STUART; WILTSHIRE, 2003).

Jaw can be expanded through non-surgical approach based on incomplete closure of facial sutures in children. ERM of 0.5 mm per day, for 15 days, is half term between pain and efficiency. It is not perfect solution, but allows recovery of transverse growth by mechanical enlargement. Palatal expansion, too, open nasal cavity that becomes more permeable to passage of air. Preterm treatment (7-8 years) provides excellent results, and procedure can occur at greater age (13 to 14 years), but with worse results (SOREL, 2004).

When assessing areas of greater resistance to separation movement of maxillary bones, it was observed that area of greater resistance would not be intermaxillary suture, but other maxillary joints, such as maxillary and pterygomaxillary zygomatic sutures (ISAACSON; INGRAM, 1964).

To eliminate areas of bone strength prior to expander activation, osteotomies of lateral walls of maxilla as well as surgical opening in midline of palate are described (LINES, 1975). In addition, maxillary osteotomies can be accompanied by reduction in resistance to lateral movement by osteotomies in maxillary nasal, pterygomaxillary and zygomatic (KENNEDY III; BELL; KIMBROUGH et al., 1976).

Described osteotomies are safe and effective for treatment of unilateral and bilateral maxilla deficiencies. ERM in 15 adults accompanied by separation of maxillary bones in nasal process of maxilla, maxillary zygomatic
sutures and, pterigomaxillary suture, led to success in expansion and percentage of relapse was not significant (BELL; EPKER, 1976).

Such maxillary osteotomies are necessary for treatment of various clinical manifestations of horizontal maxillary deficiency and consequent crossbite. Important diagnosis, treatment plan, and technical considerations necessary for successful orthodontic correction of maxillary atresia should be performed (BELL; JACOBS, 1979).

ERM success can be assessed by opening intermaxillary suture. Osteotomies of lateral wall of maxilla in 25 patients were combined with pterygomaxillary disjunction and separation of maxillary bones determined success of rapid maxillary expansion in 23 patients. Two patients who did not respond to treatment had abnormally closed palatine sutures and had expansion successfully performed after sutures were osteotomized (KRAUT, 1984).

Vascular considerations for orthognathic maxillary surgery procedures were studied and discussed. In monkey study, Le Fort I osteotomies were performed and, after certain period, vascular changes were studied in maxilla. Performed correctly, this procedure leads to minimal permanent changes in this structure (EPKER, 1984).

ERM can be done with use of lateral maxillary corticotomies and, palatal expander type HYRAX, in treatment of adult patients with maxillary atresia. In all 16 cases treated, separation of intermaxillary suture was confirmed by occlusal radiographs and by diastema between upper central incisors. Osteotomies of intermaxillary or pterygomaxillary suture were not used (GLASSMAN; NAHIOGIAN; MEDWAY et al., 1984).

Osteotomy of maxillary zygomatic suture in combination with MRA is reliable technique for treatment of horizontal maxilla deficiencies in adults. This procedure was used in 18 patients, with excellent expansion in 17 cases. In one patient expansion was interrupted previously overcorrection because of pressure necrosis on palate caused by expander. Three patients in this series had subsequent orthognathic surgery and, after 1 to 6 years of follow-up, there was no recurrence. In opinion of authors, maxillary zygomatic suture is primary area of resistance for lateral movement of maxilla, in accomplishment of ERM (LEHMAN; HAAS; HAAS, 1984).

Authors advocate preforming surgical expansion of maxilla at outpatient level, under local anesthesia. It is reported success in ERM of patients using only osteotomies of anterior and lateral walls of maxilla and of intermaxillary suture, through conservative incisions in fundus of maxilla, with use of anesthesia by blockage of maxillary nerve and infiltrative terminals (BAYS; GRECO, 1992).
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Authors have maintained proposed technique (Bell, Epker, 1976), with osteotomy of anterior and lateral walls of maxilla, pterygomaxillary suture and, intermaxillary osteotomy. Forty-eight hours after surgery, expansion begins, with quarter turn of expander per day. At end of expansion, expander was maintained for another three months and, acrylic restraint was used for another three months. After 12 months postoperatively, through analysis of occlusal radiographs, regeneration of sutures could be observed (Mossaz; Byloff; Richter, 1992).

Study was carried out where twelve patients with transverse maxillary deficiency greater than 5 mm were surgically treated through ERM. Procedure consisted of bilateral osteotomies of zygomatic pillar and intermaxillary suture combined with expander use in postoperative period. Mean palatal expansion of 7.5 mm (range of 6 to 13 mm) measured in first molar region was achieved after 3 weeks in all patients. ERM remained stable during 12-month study period, with mean recurrence in all groups of 0.88 +/- 0.48 mm. Morbidity was limited to mild post-operative discomfort (Pogrel; Kaban; Vargervik et al., 1992).

Study was performed to verify stability after transverse maxillary expansion via Le Fort I osteotomy with segments in 39 patients. Mean expansion was 5.4 mm in second molars, decreasing almost linearly to 2.8 mm in the first premolars. Postoperative recurrence was also higher in second molars, with mean of 2.6 mm. Percentage of recurrence was higher later, decreasing from 49% in second molars to 30% in first premolars. Amount of postoperative recurrence was significantly higher in those who had concomitant mandibular surgery. To improve clinical results, authors recommend moderate over-expansion in surgery for major transverse changes, maintenance of acrylic plaques in postoperative (Phillips; Medland; Fields et al., 1992).

Study to verify forces generated during orthodontic-surgical expansion of maxilla, was constructed photoelastic analogue to verify stress developed in different areas of the craniofacial skeleton. Hyrax Expander was installed on analog and incrementally enabled. Sequential cuts were performed to simulate osteotomies of zygomatic pillar, pterygomaxillary, and intermaxillary suture, and changes in internal stress were recorded after each individual cut. Analysis of forces generated showed that intermaxillary and pterygomaxillary joints were regions of primary resistance to expansion forces. It is concluded that complete osteotomies of intermaxillary and pterygomaxillary sutures are essential for predictable skeletal expansion in adults. Use of osteotomies only of zygomatic abutments seems to be inadequate (Shetty; Caridad; Caputo et al., 1994).
In ERM of 20 patients, results after orthodontic treatment were evaluated. Mean age of patients was 36.3 years and were followed up for 3 years and 6 months. Results were found to be reliable in long run. Definitive expansion in the first molar region was 7.1 mm +/- 2.4 and in the canine region 4.8 mm +/- 2.7. Relapse observed after control period was located in respective regions 1.2 mm +/- 1.3 and 0.2 mm +/- 2.1. This study also supports theory that sutures, anterior to incisor canal, never ossifies, throughout life of individual (STROMBERG; HOLM, 1995).

Osteotomies are described only in region of zygomatic pillars, through small incision in vestibular mucosa and, osteotomy of medial palatine suture after incision in vestibular mucosa above upper incisors. Authors do not indicate osteotomies of pterygomaxillary junction (MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998).

In surgical expansion of conventional maxilla, diastema is opened between central incisors. It is presented case in which surgical procedure was modified so that separation of hemi-maxilla occurred in region of lost lateral incisor, instead of midline. This facilitated rehabilitation of space with use of prosthesis installed immediately after surgery (PEARSON; DAVIES; Sandler, 1996).

Some patients with palatal fissure show severe transverse maxillary deficiency and posterior crossbite. It is demonstrated surgical orthodontic treatment of one of these patients, where osteotomy was performed on vestibular and lingual surfaces of alveolar process in posterior region. Hyrax type expander was used and screw (0.2 mm, one quarter turn) was activated two to three times per day. Gain of expansion achieved using ERM was higher in posterior region than in anterior region of maxilla. After orthodontic treatment, occlusal stability was satisfactory (SUSAMI; KURODA; AMAGASA, 1996).

Some orthodontic-surgical techniques for treating deficiencies in adult patients differ from those previously described. Special references are made for surgical release of various circum-maxillary joints to facilitate use of fixed expander. However, an osteotomy performed below anterior nasal spine is added to ensure that nasal septum remains independent of maxillary segments and does not move during its separation (WOODS; WIESENFELD; PROBERT, 1997).

ERM, also, can be performed at outpatient level, using trunk maxillary nerve anesthesia. Twelve patients with transverse maxillary discrepancies were treated in this manner from 1994 to 1995. Blockade was performed with an 8-cm spinal needle, along with intraoral anesthesia of sphenopalatine ganglion. Mepivacaine without epinephrine and sodium /
bicarbonate 1/10 was used for transcutaneous anesthesia and lidocaine-prilocaine for intraoral anesthesia (MARZOLA, 2017). Osteotomies of anterior and lateral walls of maxilla, osteotomy of anterior portion of lateral wall of nose, osteotomy of pterygomaxillary suture, and palatine osteotomy were performed in all patients. Ease of obtaining effective anesthesia before and after operation and absence of side effects make this anesthesia particularly useful in ERM (ROBIONY; DEMITRI; COSTA et al., 1998).

Proximity between roots of upper central incisors represents problem in ERM. During surgical fracture of this interdental area, it is possible that separation occurs between the root surface and bone. However, it is essential that the gingival insertion remains intact. Resulting bone failure is difficult to treat with bone graft procedures because it is defect of few walls. Postoperative periapical Rx should be performed to determine where interdental separation occurred. Expansion velocity should be adjusted depending on symmetry of separation and health of gingival insert (CURETON, CUENIN, 1999).

Due to proximity of pterygomaxillary suture with pterygopalatine fossa and, consequently, the anatomical structures that cross it, such as nerve and maxillary artery, and its terminal ramifications as descending palatine artery, reported greater risk of hemorrhage when osteotomy of this suture is performed (MEHRA; COTTRELL; CAIAZZO et al., 1999).

Authors have reported development of gingival recess in upper arch teeth after maxillary expansion. Objective of this study was to compare incidences in patients treated with surgically assisted rapid expansion of maxilla and with orthopedic expansion. Both treatments reached the goal of expanding transverse dimension (5.3 and 4.4 mm, respectively), but significant difference was found between the incidence of gingival recession of premolars and maxillary molars, being more than twice as high in second procedure as in the first. ERM has been shown to be safer than orthopedic treatment in relation to possibility of developing muco-gingival problems (CARMEN; MARCELLA; GIUSEPPE et al., 2000).

ERM can be obtained with the use of Le Fort I osteotomy with medial osteotomy of palate being maxilla totally liberated to achieve desired expansion. There are several advantages such as bone juxtaposition in osteotomy sites, reduced risk of dental or extrusion compared with orthopedic procedure, elimination of second surgical time for correction of complex deformities that require few segmental osteotomies (GILON; HEYMANS; LIMME et al., 2000). Bone movement in orthognathic surgery gives rise to changes in the position of adjacent soft tissues, with each varying according to location.
and degree of movement. This study aimed to characterize soft tissue changes induced by the different suture techniques in the upper lip in patients undergoing surgical maxillary expansion. 23 patients were divided into 2 groups and analyzed, with group 1 receiving conventional suture and group 2 receiving V-Y suture. From these results, it was possible to detect posterior positioning tendency of upper lip, which could be compensated by the V-Y suture. Changes in vertical position of soft tissues were not significant (NARY FILHO; GONCALES; BERRENTIN-FELIX et al., 2002).

Between 1991 and 1997, surgical expansions of 21 patients with transverse maxillary discrepancies were performed using a previously described method, summarizing an osteotomy only of the anterior and lateral walls of maxilla (GLASSMAN, NAHIOGIAN; MEDWAY et al., 1984). Authors achieved good results in 20 patients. Another one that was operated at 38 years of age developed fracture of the alveolar process of the maxilla on one side because it presented ossification in the midline of the palate. Authors conclude that this technique is acceptable for patients up to 30 years. Above this age they require complementary osteotomy in region of intermaxillary suture (SCHIMMING; FELLER; HERZMANN et al., 2000).

ERM can be performed hemi-maxilla through distraction osteogenesis, with distractors (Surgi-Tec NV, Bruges, Belgium) installed on the palate. Osteotomies are performed in same manner as those used for ERM, all of them approaching the fundus of buccal groove. Distractor is installed through mucoperiosteal incision in palatine vault, being fixed at height of second premolars with 5 mm titanium screws. Separation of pterygomaxillary suture was not performed. Increases in width of 35.7%, 31.7%, and 22.7% were noted in canine, premolar and molar regions, respectively. Expansion in frontal plane occurred with small slope of segments (PINTO; MOMMAERTS; WREAKES et al., 2001).

Little is known about effects of surgical maxillary expansion in the nasopharyngeal space. To evaluate such alterations, 30 subjects were studied, with permanent dentition, maxillary constriction and posterior crossbite. Nasopharyngeal space was determined using digital planimeter on lateral cephalometric radiographs taken before and after ERM. Size of nasal cavity was evaluated with anteroposterior radiographs. In both groups, nasopharynx volume was increased through expansion, with no statistically significant differences between groups. Volume of nasal cavity, too, increased (BASCIFTCI; MUTLU; KARAMAN et al., 2002).

Success of ERM depends on maintaining adequate blood supply to mobilized segments. Effects of corticotomy of lateral walls of maxilla and of osteotomy of midline in blood flow of the dental pulp were described. Results
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indicated that pulp ischemia may occur through the Le Fort I osteotomy. Authors conclude that osteotomies 5 mm above apexes of maxillary teeth and of intermaxillary suture did not lead to any permanent effect on pulpal blood flow (OZTURK; DORUK; OZEC et al., 2003).

Long-term stability of ERM was evaluated in 20 patients, 14 women and 6 men, whose malocclusions were treated only or partially with MRE during 1988-1996. Surgical technique consisted of minimally invasive osteotomy of the lateral walls of the maxilla. Results indicated that (1) ERM is possible when minimally invasive surgical technique is used, (2) long-term stability of MRA through the present technique compares favorably with expansion and stability obtained with other more invasive osteotomies. More extensive osteotomies may be recommended in older patients (ANTTILA; FINNE; KESKI-NISULA et al., 2004).

Osteotomies for surgical expansion can be performed by submucosal access, with small incision in region of piriform opening. Departing from this incision is mucosa detachment and submucosal osteotomy of lateral walls and of intermaxillary suture (ZAHL; GERLACH, 2004).

Treatment of dentofacial deformities is often complicated by existence of discrepancies in transverse dimension of maxilla. Correction of these deformities, orthopedic or orthopedic-surgical, aims at separating maxillary bones in region of intermaxillary suture. ERM is effective technique in treatment of these deformities, but is limited by the stage of development of individual. Presented case of female patient, 22 years old, with transverse maxillary deficiency, submitted to ERM. Osteotomies were performed on anterior and lateral walls of maxilla, pterygomaxillary suture, nasal septum and intermaxillary suture. Techniques described for carrying out this procedure, and its effectiveness, are discussed. Due to discordance presented in literature on treatment of this type of deformity, mainly in relation to decision to orthodontic or orthodontic-surgical expansion, and to surgical technique to be used, this work was carried out, with purpose of defining conduct to be followed (ZORZETTO; MARZOLA; TOLEDO-FI. et al., 2005).

Results obtained with expansion

Nine adult patients with transverse maxillary deficiency were examined to determine the incidence of deviations of nasal septum through orthodontic-surgical maxillary expansion. Osteotomies for ERM facilitation did not include nasal septum osteotomy. Procedure included osteotomy of lateral walls of maxilla, of pterygomaxillary suture and of intermaxillary
suture. Results showed no significant changes in nasal septum position after surgery. Authors conclude that osteotomy of nasal septum to prevent septal deviation during ERM does not guarantee expected result (SCHWARZ; TRASH; BYRD et al., 1985).

It has been suggested that ERM can be justified based solely on consideration of the airways. This study evaluated effects of MRE and surgical expansion on nasal airspace. Results demonstrate that both procedures generally increase nasal air space. However, approximately one-third of subjects in both groups did not have sufficient improvement to eliminate probability of mandatory nasal breathing. These findings suggest that maxillary expansion only for increased airspace is not warranted (WARREN; HERSHEY; TURVEY et al., 1987).

There are differences between dental and skeletal changes over time caused by orthodontic expansion and, ERM. Sample was divided into two groups and in one group it was orthopedically expanded and consisted of 14 men and 10 women, ranging in age from 6 to 12 years, with average of 8.5 years. Group 2 was submitted to ERM, consisting of 12 men and 16 women aged 13-35 years, with mean of 19.25 years. Anteroposterior cephalometric models and radiographs were performed immediately before and after expansion, at expander removal, and one year after removal. Both groups showed stable results (BERGER; PANGRAZIO-KULBERSH; BORGULA et al., 1998).

Effects of maxillary constriction on pathophysiology of obstructive sleep apnea are not clear. It is known that subjects with maxillary constriction have increased nasal resistance and, resulting mouth breathing, findings typically seen in patients with apnea. Objective of this study was to investigate the effects of ERM on this change. Ten young adults (8 men, 2 women, mean age 27 +/- 2 years) with mild to moderate OSA and confirmed maxillary atresia on physical examination were submitted to MRA. Six cases required complementary surgical procedure. Nine of ten patients reported decreased snoring and hypersensitivity. In seven patients, apnea / hypopnea index returned to normal and only one patient did not show improvement (CISTULLI, PALMISANO, POOLE, 1998).

ERM can lead to changes in the soft tissues of the face. We studied 44 patients with unilateral and bilateral crossbite. Twenty-four required MRE, and the remaining 20 were treated with orthopedic expansion. Ten measurements were taken from standard face frontal photographs, in 5 treatment intervals: initial, expander installation, expiration expiration, expander removal and one year retention. Differences between initial pattern and one-year group were found for nose width (P <.001) of both groups, both
surgical and non-surgical (BERGER; PANGRAZIO-KULBERSH; THOMAS et al., 1999).

Study to investigate changes in nasal air space through transverse osteogenic distraction of the maxilla through acoustic rhinometry was performed with eight patients, with severe transverse maxillary deficiency, undergoing surgical maxillary expansion with local and general anesthesia. Measurements of nasal air space, nasal volume and cross-sectional area of pharyngeal sphincter were performed. Significant increase in nasal volume was registered in all patients, mainly in posterior region (KUNKEL; EKERT; WAGNER, 1999).

ERM carries changes in skeletal structures of the middle third of face. Ten patients (mean age 28.5 years) were investigated using acoustic rhinometry, analysis of study models and sonography, before and after surgical procedure for maxillary expansion. Measurements revealed that ERM resulted in transverse expansion of the maxilla, substantial enlargement of the maxilla and palatine vault, providing space for the tongue, improving swallowing, and preventing recurrence. There was significant reduction in nasal resistance associated with increased nasal cavity volume (WRIEDT; KUNKEL; ZENTNER, 2001).

Nasal resistance can be assessed using acoustic rhinometry. Group of 22 children (13 girls and 9 boys) with mean age was 12.9 +/- 1.54 years and maxillary atresia were submitted to MRA before and after procedure. Acoustic rhinometry was used to measure nasal resistance before, during and after expansion, and at the end of splint. Subjective assessment of changes reported in nasal breathing were also taken after expansion. Results showed that nasal resistance was significantly reduced with MRE use. No differences were found in results with use of decongestants. Subjective evaluation showed that 59% of the patients considered that their nasal breathing had improvements after ERM (DORUK; SOKUCU; SEZER et al., 2004).

**Post Operative Complications**

ERM may be effective in increasing airflow in patients with airway stenosis. Greatest benefit is when stenosis is located primarily in anteroinferior region, while those with stenosis in postero-superior portion of the nasal cavity do not benefit from palatal expansion (WERTZ, 1967).

Authors report that greatest error in ERM is underexpansion, and even when it appears to be adequate, postoperative recurrence, which is expected, may lead to insufficient maxillary width in the long term.
Therefore, it is proposed to perform over-expansion, predicting certain degree of relapse (HAAS, 1980).

In orthodontic-surgical expansion in 56 patients, 22 males and 34 females, 19 to 47 years old, satisfactory expansion was achieved in all patients, and desired amount of maxillary expansion was achieved on 12th and 28th day. In two patients, expansion was interrupted before overcorrection by necrosis caused by pressure on palate by expander. There was not enough expansion, however, treatment was subsequently completed after mucosal healing. Three other patients had some degree of ulceration of mucosa and, expansion was interrupted and restarted with slower speed, or removal of expander, with no other complications. Intermaxillary suture osteotomy was required in 30% of patients (LEHMAN; HAAS, 1990).

It is reported a higher risk of hemorrhage when pterygomaxillary suture osteotomy is performed, due to presence of important blood vessels in this region, such as pterygoid plexus, maxillary artery and its terminal branches, such as descending palatine artery (MEHRA; COTTRELL; CAIAZZO et al., 1999).

ERM generates heavy forces exerted on the pulp tissue of premolars that anchor the expander apparatus, causing changes in them. To evaluate effects by microscopic and histomorphometric methods, we evaluated 34 healthy upper premolars, which would be extracted as part of the orthodontic treatment. After extraction, teeth were prepared for microscopic examination under light microscopy. In evaluated parameters, vessel area and minimum and maximum diameter values showed significant differences between groups. Especially between the control group and 3-month postoperative group. In conclusion, authors report that ERM forces cause an adaptive response of vascular tissue, in addition to a certain degree of fibrosis in the pulp of these teeth (KAYHAN; KUCUKKELES; DEMIREL, 2000).

There were also observed effects of orthopedic forces produced by ERM on pulp tissue of premolars. Teeth, extracted as part of orthodontic treatment, 3, 6 and 18 months after ERM, were analyzed using histopathological techniques. Diameter of the vessels, hemorrhage, congestion and infiltration of inflammatory cells varied between groups and, differences between control group and 3 months, and 3 months, and 18 months were more significant. Authors conclude that ERM forces cause reversible vascular changes in pulp tissue of upper premolars (TASPINAR; AKGUL; SIMSEK et al., 2003).

It can also lead to dental rotation and slope immediately after ERM. Fourteen patients, 10 women and four men, mean age 25.6 years, who
needed this procedure were evaluated. Palatal expander was cemented in first premolars and first molars of each patient, one week before surgery. Models of study of the maxilla were performed before surgery and, 2-3 weeks after the end of expansion (7 mm). Results showed that from pre-to post-expansion, first premolars and first molars presented mesiobuccal rotation and buccal inclination. Some reasons for expansion are suggested to compensate for relapse presented in postoperative period, also influenced by relapse of inclination of teeth (CHUNG; GOLDMAN, 2003).

**CLINICAL AND SURGICAL CASE REPORT**

Patient E. P. 22 years old, female, leucoderma, presenting transverse maxillary deficiency, was referred by the orthodontist for surgically assisted rapid expansion (Figures 1 and 2). He reported previous orthodontic treatment for nine years, with another professional.

During physical examination, maxillary atresia was observed, with an oval-shaped palate, posterior crossbite on right side, and bite end to end on left side, in usual position (Figures 3, 4 and 5). Study models were made and, during their evaluation, when were placed in class I of canines, there was bilateral posterior crossbite.

**Figures 1 and 2** - Frontal and patient profile appearance.
**Source** - Private collection of Prof. Daniel Luiz Gaertner Zorzetto.
Patient was informed of necessity of surgical procedure, being explained in detail, including regarding the accomplishment in hospital environment, with general anesthesia. Thus, laboratory tests (blood count, coagulogram, blood glucose) and pre-surgical evaluation with anesthesiology team were performed.

With patient in horizontal dorsal decubitus position, under general anesthesia, and surgical procedure was begun, then infiltrative terminal anesthesia with xylocaine 2% with vessel was performed for hemostasis (MARZOLA, 2017).

Figures 3, 4 and 5 - Intraoral aspect of patient, noting crossbite posterior right side and top to left side. Severe gingival recess is also observed in upper and lower teeth. Source – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Approach was started with incision in groove bottom of maxilla, from 2nd left premolar to 2nd premolar on other side (Figure 6). Flap detachment, with exposure of anterior and lateral walls of maxilla, pyriform aperture, and submucosal access through this incision for pterygomaxillary suture (Figure 7).
Surgically assisted rapid maxillary expansion – Literature review and clinical surgical case presentation.


**Figure 6** - Approach, with incision in groove bottom.
*Source* – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

**Figure 7** - Dipping of flap, with exposure of piriform aperture.
*Source* – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Osteotomy with striker saw, from piriform aperture to lateral wall of maxilla, posterior to zygomatic pillar (**Figures 8 and 9**). Osteotomy of pterygomaxillary suture (**Figure 10**) and nasal septum followed (**Figure 11**).

**Figure 8** - Beginning of osteotomy of anterior and lateral walls of maxilla.
*Source* – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Figure 9 – After performing osteotomies of anterior and lateral walls of maxilla.
Source – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Figure 10 – Osteotomy of pterygomaxillary suture, with angled chisel, noted index finger of surgeon checking chisel action.
Source – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Figure 11 – Osteotomy of nasal septum, from anterior nasal spine, in order to prevent it being deviated to one side during separation of jaws.
Source – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Anterior activation of 2 mm, or eight quarters of turn in expander and, subsequently, intermaxillary suture osteotomy (Figures 12 and 13), thus closing osteotomies (Figure 14). Partial deactivation of expander, maintaining the opening of 1 mm. Synthesis of soft tissues was performed with vicryl 4-0, with scalloped continuous suture (Figure 15).
Figures 12 and 13 – Intermaxillary suture osteotomy, with straight chisel positioned in midline between apexes of roots of upper central incisors. Observed ischemia of inserted gingiva, by separation of maxillary bones after osteotomy.

**Source** – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Figure 14 – Osteotomies performed, observing diastema in region of upper incisors.

**Source** – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.
SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION - LITERATURE REVIEW AND CLINICAL SURGICAL CASE PRESENTATION

Figure 15 – Immediate postoperative appearance, with soft tissue synthesis performed with vicryl 4-0 and continuous scalloped suture.

Source - Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Patient was discharged 24 hours after surgical procedure and the device was started 48 hours later. Evaluated and photographed in postoperative of 01, 07, 14, 21 and 76 days. In postoperative period of 07 days, it had an inter-incisor aperture of 03 mm (Figure 16). At 14 days, 05 mm and at 21 days of 08 mm (Figure 17).

Figures 16 and 17 – Postoperative control of 07, with diastema of 03 mm and, at 21 days, with diastema of 08 mm, respectively.

Source - Private collection of Prof. Daniel Luiz Gaertner Zorzetto.
Postoperative radiographs of 02, 14 and 21 days showed integrity of the medial hard blade to maxillary incisors and separation between maxillary bones (Figures 18, 19 and 20).

Figs. 18, 19 and 20 – Postoperative occlusal radiographs with 07, 14 and 21 days, respectively. We observed maintenance of medial hard blade to upper incisors, besides effective separation of maxillary bones in midline.

Source – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

Control of 76 days was observed spontaneous decrease of diastema of anterior region, by action of interdental periodontal fibers (Figures 21, 22 and 23).

Figures 21, 22 and 23 – Postoperative control of 76 days, noting correction of posterior crossbite and reduction of diastema in anterior region.

Source – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.
There was correction of cross-bite presented by patient, and comparison of preoperative photograph with that of 21-day postoperative showed significant improvement of transverse deficiency (Figures 24 and 25). Expander apparatus was maintained for three months and acrylic containment plate for another three months. After this period, patient continued treatment with orthodontist to finalize case.

**Figures 24 and 25** – Postoperative occlusal aspect and, postoperative with 76 days, where noticeable improvement of horizontal maxillary deficiency is observed. **Source** – Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

**DISCUSSION**

Transverse maxillary deficits can be corrected by orthodontic treatment or the orthodontic/surgery association (BELL; PROFFIT; WHITE, 1980). Orthodontic expansion is limited by stage of patient’s development, being possible during period of growth, where intermaxillary suture and other sutures are still not consolidated (MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998).
Ossification in intermaxillary suture begins between 15 and 19 years, increasing significantly in third decade of life (PERSSON; THILANDER, 1977).

Therefore, authors recommend orthodontic expansion up to 25 years, and option for osteotomies when suture has not been opened after expander’s daily activation week (TIMMS; VERO, 1981). However, they believe that around the age of 18 this suture is already in process of ossification preventing orthodontic expansion (WOLFORD; EPKER, 1980). According to last authors, in presented case ERM was chosen, even though patient was 22 years old.

ERM in adults has been performed by many surgeons authors (TIMMS; VERO, 1981 and STUART; WILTSHERE, 2003), however this procedure can result in dental movement, alveolar bone loss, dental extrusion, necrosis of expander abutment teeth, and alveolar fracture (BAYS; GRECO, 1992 and CAPELLOZA-FI, CARDOSO-NETO; SILVA-FI et al., 1996).

Early work on ERM described intermaxillary suture as area of greatest resistance to separation movement of maxillary bones, although this does not seem to be true. Clinical work reported that main areas of bone resistance to this movement would be zygomatic maxillary suture, and pterygomaxillary suture (ISAACSON; INGRAM, 1964).

With detection of sutures that, after initiating consolidation, would impede or hamper maxillary arch expansion, osteotomies were proposed to reduce forces, allowing for procedure (LINES, 1975).

Accordingly, research using various types of osteotomies to facilitate ERM in monkeys showed that most effective ones to reduce resistance to lateral movement of hemi-maxilla were performed through zygomatic pillar, nasomaxillary region, and pterygomaxillary region (KENNEDY; BELL; KIMBROUGH et al., 1976).

Osteotomies described, one that generates most controversy is pterygomaxillary suture. Although many authors have defended it, as way to prevent expansion occurring only in anterior region of maxilla, being expansion of posterior region limited by pterygoid process (ISAACSON; INGRAM, 1964; BELL; EPKER, 1976; KENNEDY; BELL; KIMBROUGH et al., 1976; KRAUT, 1984; MOSSAZ; BYLOFF; RICHTER, 1992 and ROBIONY; DEMITRI; COSTA et al., 1998). Few relate lack or difficulty of expansion with failure to perform this osteotomy.

In addition, its performance would bring greater risks to procedure, such as possibility of bleeding, even contraindicating procedure with local anesthesia or conscious sedation (MEHRA; COTTRELL; CAIAZZO et al., 1999 and MARZOLA, 2017).
From works of 1970 (LINES, 1975 and BELL; EPKER, 1976), techniques have been described with aim of simplifying this surgical procedure, seeking even greater patient comfort in postoperative period. Authors defended osteotomy of anterior and lateral wall of maxilla and, intermaxillary suture (PINTO; MOMMAERTS; WREAKES et al., 2001 and OZTURK; DORUK; OZEC et al., 2003). In addition, osteotomy in region of zygomatic pillar and intermaxillary suture (BAYS; GRECO, 1992; POGREL; KABAN; VARGEVRVIK et al., 1992 and MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998).

For more conservative current, osteotomy only of lateral and anterior walls of maxilla, without osteotomy of intermaxillary suture (GLASSMAN; NAHIOGAN; MEDWAY et al., 1984 and SCHIMMING; FELLER; HERZMANN et al., 2000) etc...

Authors, however, defend performance of more complete osteotomies, with osteotomies of anterior and lateral walls of maxilla, pterigomaxillary suture, intermaxillary suture and nasal septum (WOODS; WIESENFELD; PROBERT, 1997 and ARAÚJO, 1999). ERM is indicated in horizontal deficiencies higher to 6 mm (BELL; PROFFIT; WHITE, 1980; MANGANELLO-SOUZA, SILVEIRA; CAPELETTE et al., 1998 and ARAÚJO, 1999).

Minor deficiencies may be treated only through orthodontics, or when necessary combined surgical procedure, to correct other dento-facial deformities, performed during orthognathic surgery (GILON; HEYMANS; LIMME et al., 2000; BELL; PROFFIT; WHITE, 1980; BELL; EPKER, 1976 and MANGANELLO-SOUZA, SILVEIRA; CAPELETTE et al., 1998). Therefore, ERM was chosen in this case, adding that because of periodontal compromise, orthodontic expansion would be contraindicated.

Osteotomy of the nasal septum is usually defended to prevent septal deviation accompanying separation of maxillary bones (WOODS; WIESENFELD; PROBERT, 1997 and ARAÚJO, 1999).

However, studies to evaluate this movement through radiographs and CT scans did not show statistically significant differences between cases where osteotomy was performed and those where it was not, and of authors, only two works above performed such procedure (SCHWARZ; TRASH; BYRD et al., 1985). Although this osteotomy was performed in reported case, it may not be performed, without this reflecting on the final result. In the case of unilateral transverse deficiencies that require surgical expansion, techniques may be chosen, with osteotomies on only one side, associated with the intermaxillary suture osteotomy (MANGANELLO-SOUZA; SILVEIRA; CAPELETTE, 1998 and ARAÚJO, 1999).
Table 1 - Summary of techniques for ERM.

<table>
<thead>
<tr>
<th>AUTHORS</th>
<th>SURGICAL TECHNIQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINES, 1975</td>
<td>Osteotomies of lateral and anterior walls of maxilla, and medial palatine suture. General anesthesia.</td>
</tr>
<tr>
<td>BELL, EPKER, 1976</td>
<td>Osteotomies of anterior and lateral walls of the maxilla only. Without intermaxillary suture osteotomy. Local anesthesia.</td>
</tr>
<tr>
<td>GLASSMAN et al., 1984</td>
<td>Lateral walls of maxilla, pterygomaxillary suture and intermaxillary suture. General anesthesia.</td>
</tr>
<tr>
<td>KRAUT, 1984</td>
<td>Zygomatic maxillary suture only, without intermaxillary or pterygomaxillary suture osteotomy. Local anesthesia.</td>
</tr>
<tr>
<td>LEHMAN; HAAS; HAAS, 1984</td>
<td>Lateral walls of maxilla, pterygomaxillary suture and intermaxillary suture.</td>
</tr>
<tr>
<td>SCHWARZ, et al., 1985</td>
<td>Osteotomy of nasal septum was not performed, and there were no statistical differences between performance of this surgical step or not. General anesthesia.</td>
</tr>
<tr>
<td>BAYS; GRECO, 1992</td>
<td>Anterior and lateral wall of maxilla, intermaxillary suture. Local anesthesia.</td>
</tr>
<tr>
<td>MOSSAZ; BYLOF; RICHTER, 1992</td>
<td>Anterior and lateral wall of the maxilla, pterygomaxillary junction and intermaxillary suture. General anesthesia.</td>
</tr>
<tr>
<td>POGREL et al., 1992</td>
<td>Osteotomies of zygomatic pillars and intermaxillary suture. Local anesthesia.</td>
</tr>
<tr>
<td>SHETTY; CARIDAD; CAPUTO, 1994</td>
<td>Osteotomies of zygomatic and maxillary sutures, pterygomaxillary and intermaxillary suture. General anesthesia.</td>
</tr>
<tr>
<td>WOODS; WIESENFELD; PROBERT, 1997</td>
<td>Osteotomies of zygomatic pillars and intermaxillary suture. Local anesthesia.</td>
</tr>
<tr>
<td>MANGANELLO-SOUZA et al., 1998</td>
<td>Osteotomies of maxillary zygomatic, pterygomaxillary and intermaxillary sutures. General anesthesia.</td>
</tr>
<tr>
<td>ARAÚJO, 1999</td>
<td>Anterior wall of maxilla, pterygomaxillary junction, intermaxillary suture, nasal septum. General anesthesia.</td>
</tr>
<tr>
<td>ROBIONY; DEMITRI; COSTA et al., 1998</td>
<td>Anterior and lateral maxillary osteotomies, pterygomaxillary suture, nasal septum and intermaxillary suture. General anesthesia.</td>
</tr>
<tr>
<td>ZAHL; GERLACH, 2004</td>
<td>Osteotomies anterior and lateral wall of the maxilla, nasal process of the maxilla, pterygomaxillary junction, intermaxillary suture. Local anesthesia.</td>
</tr>
</tbody>
</table>

Source - Private collection of Prof. Daniel Luiz Gaertner Zorzetto.

In present study, maxillary bones were divided into two groups, maxillary bone, maxillary bone, and maxillary maxillary line (LINES, 1975; BELL; EPKER, 1976; GLASSMANN, NAHIOGIAN, MEDWAY et al., 1984; BAYS; GRECO, 1992; POGREL; KABAN; VARGREVK et al., 1992; MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998; ARAÚJO, 1999; CURETON; CUENIN, 1999; SCHIMMING; FELLER; HERZMANN et al., 2000; PINTO; MOMMAERTS; WREAKES et al., 2001; NARY FILHO; GONÇALES; BERRENTIN-FELIX et al., 2002 and OZTURK; DORUK; OZEC et al., 2003). In this study, results of present study are presented (Table 1).

In some cases, it can be performed in lateral incisor region, when absence of this element caused by agenesis, or in cleft palates, to facilitate osteotomy. In this region, avoiding risk of damage to roots of central incisors, due to their proximity (PEARSON; DAVIES; SANDLER, 1996).

Authors describe surgical procedure for MRE under local anesthesia (GLASSMAN, NAHIOGIAN, MEDWAY et al., 1984; BAYS; GRECO, 1992; POGREL; KABAN; VARGREVK et al., 1992; MANGANELLO-SOUZA; SILVEIRA, CAPELETTE et al., 1998; ROBIONY, DEMITRI, COSTA et al., 1998 and ZAHL; GERLACH, 2004). However, aggressiveness of same, possibility of surgical accidents, risk of excessive bleeding, and painful trans-surgical sensation, lead to option of general anesthesia (LINES, 1975; BELL; EPKER, 1976; KENNEDY, BELL, KIMBROUGH et al., 1976; KRAUT, 1984; SCHWARZ, TRASH, BIRD et al., 1985; MOSSAZ, BYLOF, RICHTER, 1992; SHETTY; CARIDAD CAPUTO et al., 1994; WOODS WIESENFIELD, PROBERT, 1997 and ARAÚJO, 1999). According to these authors, procedure was performed under general anesthesia (MARZOLA, 2017).

Activation of the expander apparatus starts from 24 to 48 hours, moving from 0.25 to 0.5 mm per day. In this work, it is possible to observe influence of the acrylic resin on acrylic resin and its properties, as well as on properties of acrylic resins (SUSAMI; KURODA; AMAGASA, 1996; MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1998 and ARAÚJO, 1999). They also report that some expansion is necessary to prevent recurrence (PHILLIPS; MEDLAND; FIELDS et al., 1992). Thus, activation of the expander started at 48 hours with 0.25 mm expansion, 2 times per day, with an approximate expansion of 2 mm, determined by orthodontist.

Periapical and occlusal radiographs should be performed periodically after ERM, to determine if the lamina dura was maintained medially to incisors, or whether or not it is being reabsorbed due to the speed
of expansion. Efficacy of the expander, with separation of maxillary bones can be evaluated, and bone neoformation can be monitored (CURETON, CUENIN, 1999 and NARY-FI; GONÇALES; BERRENTIN-FELIX et al., 2002).

Improvement of airway stenosis has been reported after both orthodontic and surgical maxillary expansion. Greatest benefit is when stenosis is located primarily in anteroinferior region, while those with stenosis in postero-superior portion of nasal cavity do not benefit from palatal expansion (WERTZ, 1967). It is in agreement with other studies that, in addition to increase of nasal cavity volume, observed nasopharyngeal enlargement after expansion (BASCIFTICI, MUTLU; KARAMAN et al., 2002; KUNKEL; EKERT; WAGNER, 1999 and WRIEDT; KUNKEL; ZENTNER, 2001).

It has also been reported that some of complications caused by obstructive sleep apnea may be ameliorated by surgical expansion of maxilla. This is because this procedure leads to increased nasal cavity volume and nasopharyngeal space, reducing resistance to air passage (CISTULLI, PALMISANO, POOLE, 1998). Although ERM usually increases nasal airspace, many patients are unable to expand enough to maintain strictly nasal breathing. Indication of maxillary expansion only for correction of nasal stenosis is not justified (WARREN; HERSHEY, TURVEY et al., 1987).

After expansion notice (BERGER; PAGRANZIO-KULBERSH; THOMAS et al., 1999). However, this finding seems to be more related to the incision and flap made, promoting accommodation of tissues in new position than with expansion (NARY-FI; GONÇALES; BERRENTIN-FELIX et al., 2002).

During surgical procedure for MRE, soft tissue care is poorly discussed (LINES, 1975; BELL; EPKER, 1976; GLASSMANN, NAHIOGIAN; MEDWAY et al., 1984; BAYS; GRECO, 1992; POGREL; KABAN; VARGERVIK et al., 1992; MANGANELLO-SOUZA; SILVEIRA; CAPELETTE et al., 1996; ARAÚJO, 1999; CURETON, CUENIN, 1999; SCHIMMING; FELLER; HERZMANN et al., 2000; PINTO; MOMMAERTS; WREAKES et al., 2001 and OZTURK; DORUK; OZEC et al., 2003).

In this work, we present results obtained in literature. However, posterior positioning tendency of the upper lip with expansion is described. Increased maxillary width and subsequent orthodontic treatment lead to posterior positioning of anterior teeth and consequent change of upper lip in same direction. However, this change caused by expansion can be compensated by the V-Y suture during surgical procedure. Changes in vertical position of soft tissues are not significant (NARY-FI; GONÇALES;
BERRENTIN-FELIX et al., 2002). However, authors' opinion was that this maneuver was not carried out, in this case specifically.

Osteotomies performed for both surgical and orthognathic surgeries, besides forces generated on teeth during activation of expander, may lead to pulp alterations, pulp necrosis, vestibular bone loss, gingival recession, especially in banded teeth to support expanders. However, many of these alterations are temporary, ceasing after removal of forces and/or repair of osteotomized areas, or causing slight damages (KAYHAN; KUCUKKELES; DEMIREL, 2000; OZTURK; DORUK; OZEC et al., 2003 and TASPINAR; AKGUL; SIMSEK et al., 2003), with more uncommon pulp necrosis or severe damage to periodontal tissues.

Common complication of this procedure, especially related to use of dento-muco-supported expander, type HAAS, is necrosis of regions of palatal mucosa, generated by incidence of forces at expander contact. Using the dento-supported expander, type HYRAX, can prevent excessive pressure on the palatal mucosa. On other hand, exaggerated forces on teeth that support this type of expander can lead to alveolar bone loss, gingival recessions, dental inclinations, etc. (CARMEN; MARCELLA; GIUSEPPE et al., 2000 and CHUNG; GOLDMAN, 2003). Evaluating advantages and disadvantages of each device, it was decided, together with orthodontist, to use type expander-Hyrax.

There may also be bone loss and consequent gingival recession between upper central incisors, caused by incorrect fracture line in intermaxillary suture, which would run between dental root and alveolar bone, generating bone defect of difficult treatment (CURETON, CUENIN, 1999).

There is great difficulty in pointing this or that technique as best. It is up to the surgeon to indicate which is best suited to particular case, depending on patient’s characteristics, such as age, degree of deformity, function, etc.

CONCLUSIONS

For results in literature and, case presented, it concluded that:
1. Rigorous evaluation of deformities presented by patients and of study models is necessary to determine correct indication of proposed treatment, whether surgical or not, whether bi-lateral or unilateral.
2. Transversal maxillary deficits can be corrected orthopedically, up to 25 years, but intermaxillary suture begins to consolidate between 15 and 19 years.
3. And orthopedic expansion in adults, although defended by many authors, can lead to injuries to teeth and periodontal tissues, compromising treatment success.

4. Success of procedure can be obtained through use of several of described techniques, where more complete osteotomies can ensure better results, reducing chance of dental movements, tissue damage, and relapse reduction.

5. Although more aggressive techniques can guarantee better results, literature shows that less invasive techniques can also be effective, leading to minimization of trauma to patient.

6. There are no statistically significant differences between performing or not performing nasal septum osteotomy.

7. Patient control after expansion is important procedure itself. Periodic radiographs, use of devices that prevent relapse in first months, care with oral hygiene and continuation of orthodontic or orthodontic surgical treatment guarantee the maintenance of the obtained result.

REFERENCES


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* According of the ABNT norms, modified by the Dentistry Review of the ATO.

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